Ex 3.2

Q1

outcome	Prob	$x \times P$
12	$1/2$	6
10	$1/4$	2.5
6	$1/4$	1.5
		10

$E(x) = 10.$

Q2

outcome	Prob	$x \times P$
2	$2/6 = 1/3$	$2/3$
6	$1/6$	1
8	$1/6$	$8/6 = 4/3$
9	$1/6$	$9/6 = 3/2$
12	$1/6$	2
		$\frac{13}{2} = 6.5$

Q6

$$E(x) = (0 \times 0.21) + (1 \times 0.37) + (2 \times 0.25) + (3 \times 0.13) + (4 \times 0.03) + (5 \times 0.01)$$

$$= 0.37 + 0.5 + 0.39 + 0.12 + 0.05$$

$$= 1.43.$$

Q8

outcome	P	P x x
20	1/2	10
10	1/6	10/6
5	1/3	5/3

$\sum x_i P(x) = \frac{40}{3} = 13.33$

$13.33 - 10 = 3.33$

Expect to win €3.33

It is not fair as mathematical expectation $\neq 0$.

Q9

outcome	P	x x P
(1) €10	1/6	10/6
(2) €10	1/6	10/6
(3) -€5	1/6	-5/6
(4) -€5	1/6	-5/6
(5) -€5	1/6	-5/6
(6) -€5	1/6	-5/6

$\sum x_i P(x) = 0$

Yes game is fair as expected amount is zero.

Q11 $P(\text{Dying}) = \frac{1}{1000} = 0.001$

$P(\text{Disability}) = \frac{3}{1000} = 0.003$

$(0.001)(50{,}000) + (0.003)(20{,}000)$

$= 50 + 60$

$= 110$. is expected payout

Profit = $300 - 110 = €190$ per customer.

Q13

Outcomes	P	$x \times P$
(1) €15	1/6	15/6
(2) €20	1/6	20/6
(3) 0	1/6	0
(4) 0	1/6	0
(5) 0	1/6	0
(6) €20	1/6	20/6

$\Sigma x \cdot P(x) = \frac{25}{6} = €4.17$

Cost = €5.

$\Rightarrow 5 - 4.17 = 0.83$ expected Winnings

Play 20 Times

$\Rightarrow 20 \times 0.83 = €16.67$

Ex3.2 (Text + Test 5)

Q14

(i) $0.1 + P + 0.3 + q + 0.2 = 1$

$P + q = 1 - 0.6$

(A) $\boxed{P + q = 0.4}$

$(1)(0.1) + (2)(P) + (3)(0.3) + (4)(q) + 5(0.2) = 3$

$0.1 + 2p + 0.9 + 4q + 1 = 3$

$2p + 4q = 3 - 2$

(B) $\boxed{2p + 4q = 1}$

(ii) (2A) $\ominus 2p + \ominus 2q = \ominus 0.8$

$2p + 4q = 1$

$2q = 0.2$

$\underline{q = 0.1}$

$P + 0.1 = 0.4$

$\underline{P = 0.3}$

Q15

(i) Rural $\frac{210}{4600} = 0.0456$

(ii) Expected Value $= x \cdot P(x)$

$(1705)(0.0456) = €77.836$

$= €77.84$

(iii) Urban 6250 households pay 580

480 claims of 2840

$6250 \times 580 = 3625000$ Payed

$480 \times 2840 = 1363200$ Claims

$2,261,800$ Profit

Profit Per household $= \frac{2261800}{6250} = 361.89$

(iv) $P(\text{Claim}) = 0.05$

$(1550)(0.05) = 77.50$

Profit of 350

$\Rightarrow$ Premium $= 350 + 77.50$

$= €427.50$

Q16

Section A P(A) = 1/4 P(B) = 1/4 P(C) = 1/4 P(D) = 1/4

20 Q's ⇒ Expected N° of correct
$= 20 \times \frac{1}{4} = 5$.

Section B True or False ⇒ P(correct) = 1/2

10 Q's ⇒ Expected N° correct
$= 10 \times \frac{1}{2} = 5$

Section 3 A, B, or C ⇒ P(correct) = 1/3

10 Q's ⇒ Expected N° correct
$= 10 \times \frac{1}{3} = 3\frac{1}{3}$

∴ Total Correct $= 5 + 5 + 3\frac{1}{3}$

$= 13\frac{1}{3}$.

Q17

Table 1 52 cards

Outcome	P	x × P
Heart (30)	1/4	30/4
other (−5)	3/4	−15/4

$\sum x \cdot P(x) = 15/4 = 3.75$

Costs €10

∴ Expected Value : $3.75 - 10 = -6.25$ (loss)

Table 2

Outcome	P	x × P
(10) €50	3/36	150/36
(11) €50	2/36	100/36
(12) €50	1/36	50/36
(other) −2.	30/36	−60/36

$\sum x \cdot P(x) = \frac{240}{36} = 6.67.$

∴ Expected Value : $6.67 - 10 = 3.33$ (loss).

Better Return on Table 2. Loss €3.33 on average
Whereas Table 1 loss €6.25 on average

Difference between the two
$6.25 - 3.33 = €2.92$